

ROSIDS (FABIDS): OXALIDALES

ELAEOCARPACEAE

NAME: From the genus *Elaeocarpus*, as below. No common names apply to the family as a whole.

OVERVIEW: The family Elaeocarpaceae is a small family of nine genera and 500 species. In reproductive details, these species uniformly possess valvate sepals, a disc of varied form, an ovary of fused carpels, axile ovules, and basifixed anthers. The petals are often fringed although with exceptions in each genus. In vegetative form, these are mostly small trees; the twigs bear paired stipules, the stalk is of varied length but often swollen above, below or both; the blade is commonly with a toothed margin and a blistered surface when dry. The family long held an uneasy alliance with the Malvaceae, a union now decisively dissolved by molecular evidence. In geography, the family is clearly of the Southern Hemisphere with most genera found between Australia and New Guinea. Of these, four reach our area: *Elaeocarpus* and *Sloanea* can be found as far west as China while *Aceratium* and *Doubetzia* are evidently not found further west than the Moluccas. The family and genera appear to be strongly monophyletic¹. A sound guide to the family is found in the series of publications by Mark J. Coode²⁻⁴.

ELAEOCARPUS. [Greek, olive-fruit; in reference to the shape; the olive is the genus *Olea*.] This is a genus of about 350 species distributed in the Paleotropics with a center of species richness in Borneo or between Borneo and New Guinea. The standard Malay name is *sengekurur*; BURKILL *loc. cit.* suggests that *medang musang* use to be widespread, and that is a good name in that the blue drupes do give the appearance of a Lauraceae, and they often provide an important source of food for wildlife, though perhaps not for musang in particular. Other names include *menginang* in Java, and *kungkurad* in Borneo although that should perhaps be restricted to *E. stipularis*. We find about 230 species in the *Flora Malesiana* region; 39 species in China, (14 endemic), 38 taxa in Malaya (species and varieties), and 47 in the Philippines.

Elaeocarpus are always woody, most often small trees, a few species reach diameters that exceed 60 cm DBH but even then they are not tall trees. Buttresses are uncommon among our species, although the Australian *E. angustifolius* can grow to a large diameter with extensive buttresses. The bark is variably shades of gray, brown and pink, sometimes cracked or fissured, mostly smooth and lenticellate, with a yellow-brown inner bark and pale sap wood. Common features of the leaf and twig include paired stipules, a leaf stalk swollen at least at the



Elaeocarpus ferrugineus, from Pasoh, Malaya; the species is characterized by the velvety red indumentum and the long leaf stalk; the blue fruit are typical of the genus.

upper end, toothed leaf margin, pinnate venation, and a surface that dries pimply with included crystals. The challenge in the field recognition of *Elaeocarpus* is to remember that the leaves can be arranged in several different patterns. Most often, we find the leaves in a loose spiral array with a medium length leaf stalk. A short leaf stalk and leaves arranged alternate in a plane is seen in the common species *E. stipularis*, and note the peculiar

FIELD RECOGNITION: ELAEOCARPUS

Small to medium sized trees especially in gaps, secondary forests and full sunlight.

Often in flower and fruit: look for pendent white bisexual flowers with fringed petals, often blooms in great profusion, later bearing blue olive-like fruits.

Twigs with resinous buds, stipules, especially obvious in dried specimens,

The blade various in shape, size, length of leaf stalk and arrangement; usually with toothed margins.

The leaf surface of many species has a peculiar sheen when fresh, and is often pimply in the dry leaves; many flush red and yellow, or turn bright red or yellow as they wither, sometimes dense carpets of colored leaves can be found beneath a tree.

FIELD CONFUSION

Several Euphorbiaceae with pinnate venation can be confused, especially *Neoscortechinia*; and also *Baccaurea*. These lack a resinous twig tip and *Baccaurea* lacks toothed margins.

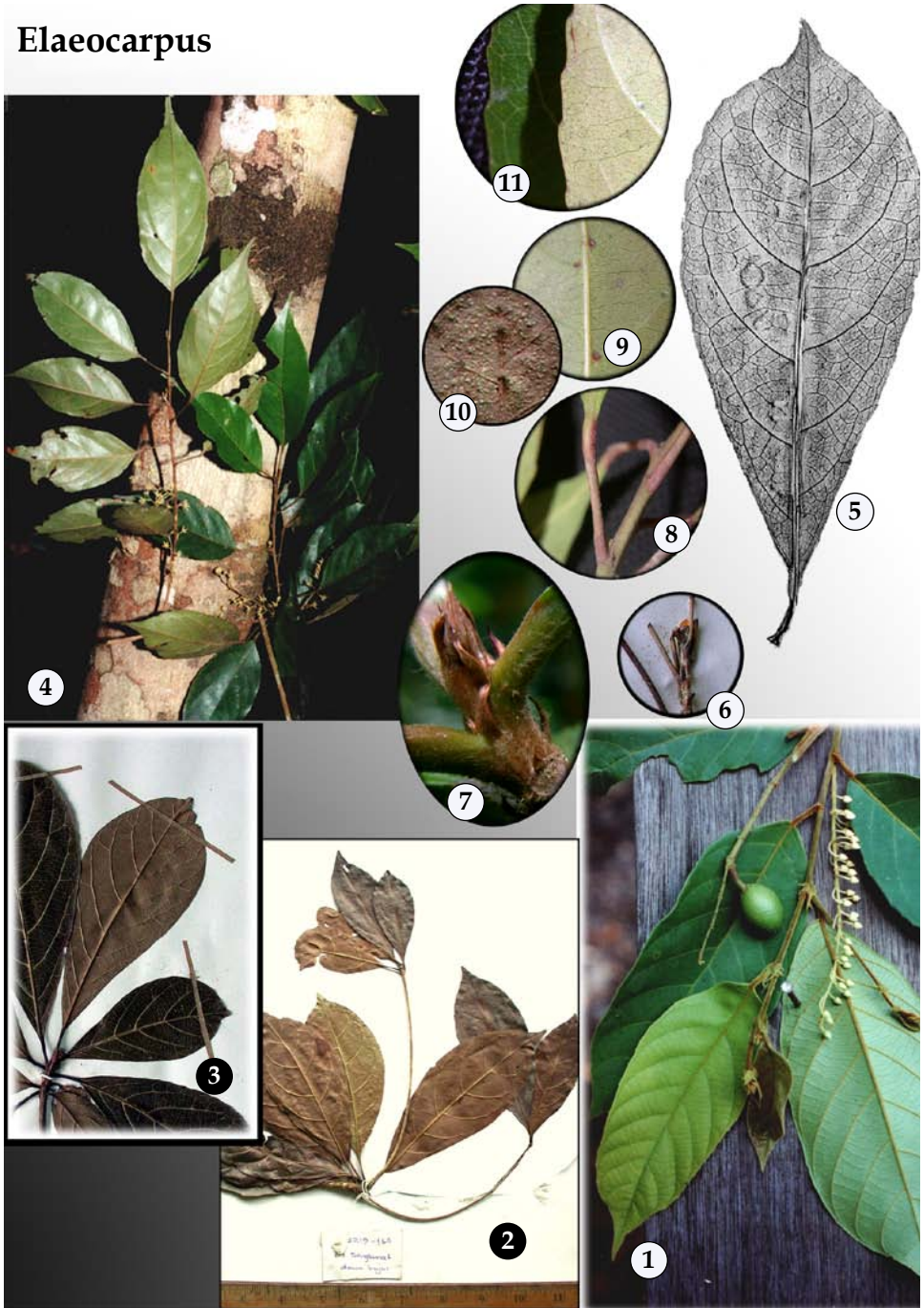
¹Crayn, D., *et al.* 2006. American Journal of Botany. 93: 1328-1342.

²Coode, M. 1983. Kew Bulletin. 38: 347-427.

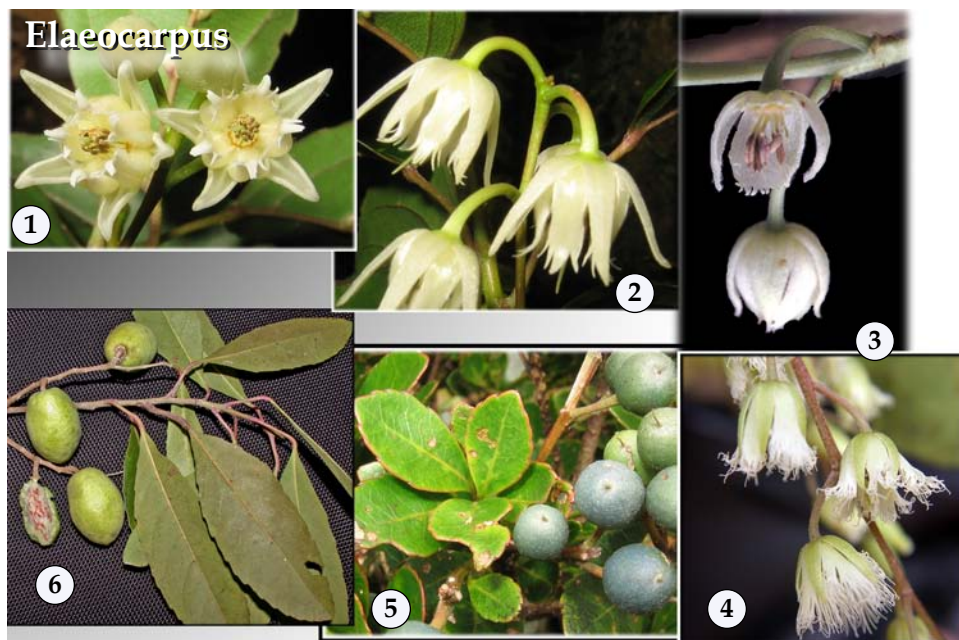
³Coode, M. 1999. Families and Genera of Vascular Plants. 6: 135-144.

⁴Coode, M. 2001. Kew Bulletin. 56: 513-565.

Elaeocarpus



Elaeocarpus. 1, *E. stipularis*, Lambir, Sarawak, a species with short leaf stalks and alternate arrangement, note the spikes of pendent flowers characteristic of the genus, and also the fruit, of nearly mature size at a time the tree still bears flowers; 2-3, species with a leaf arrangement very much like *Terminalia*, with long leafless shoots and crowded spiral clusters of short-stalked leaves; 2 *E. kostermansii*, Lambir, Sarawak; 3, *E. rugosus*, Pasoh, Malaya; 4, *E. clementii*, Lambir Sarawak, flowering at 5 cm DBH, the shiny leaves are alternate and long-stalked; 5, tracing from specimen in photograph 2, with details of venation; 6-11, various species, vegetative details characteristic of the genus; 6, the twig apex dries with resin; 7, paired stipules; 8, the leaf stalk strongly swollen above; 9, domatia are sometimes found in the axil of the main nerves; 10, the blade often dries with a pimpled texture; 11, the leaf margin coarsely toothed.



Elaeocarpus. Flowers and fruits; 1-2, from Mangan, Philippines, two views of the same species; 3, from Malaya, partially dissected to show the glandular disc; 4, finely fringed petals from Sri Lanka; 5, a mountain top species with large blue fruits; 6, typical fruit with the stone exposed. (Photographs 1-2© Ulysses Ferreras; 5 © Leonardo L. Co.)



Elaeocarpus clementii, Lambir, Sarawak, this 30 cm DBH tree grew 5 cm in the previous 10 years. The shape of the bole is typical of the genus but the color of the bark varies among species.

stipule with deeply cleft margins. A third arrangement is found in the many species that grow with a distinct *Terminalia*-like sympodial construction, the leaves then in tight condensed whorls.

In flower, *Elaeocarpus* are as distinctive as they are attractive, with dense spikes or clusters of fringed white-petaled flowers, variously odorous, fetid to perfumed. Quite often a tree bears flowers and fruits at the same time. The fruit at maturity are a characteristic blue or blue-green color, olive-like in shape with a thin oily pulp around a stone. Little is known of either pollination or dispersal, although the attractive oily fruits are greedily eaten by all larger birds and mammals.

The population ecology of these trees is not well known. In the large permanent plots of lowland forests, *Elaeocarpus* are inevitably widely dispersed at low density, they grow rapidly in gaps with rates of up to 0.5 cm DBH per year. Grown in plantations in full sun on good soil, rates of up to 2.5 cm DBH are recorded. A few species are exceedingly abundant such as *E. congestifolia* which can be patchily dominant at elevations over 2000 m on Kinabalu.

The stones are of very ancient use in India. They are strung, worn or handled in prayer, imbued with various supernatural powers of healing or good fortune. Stones with more than or less than the characteristic five furrows are especially propitious.

The wood of *Elaeocarpus* is underappreciated. It bears a nice straight grain without significant figure, light but strong, takes a good finish, although it is thought to be only moderately durable out of doors. A few species

yield edible fruit in the fashion of olives, but with more than 300 species to explore it is hard to believe that there is not a wonderful *Elaeocarpus* fruit waiting to be discovered and developed into a successful crop. Likewise, with regard to urban ornamental trees, *Elaeocarpus* is underappreciated and readily available. Neither should it be neglected as a choice for the early stages of reforestation because the fast growth in full sun and bird-dispersed fruit will accelerate the advent of other species.

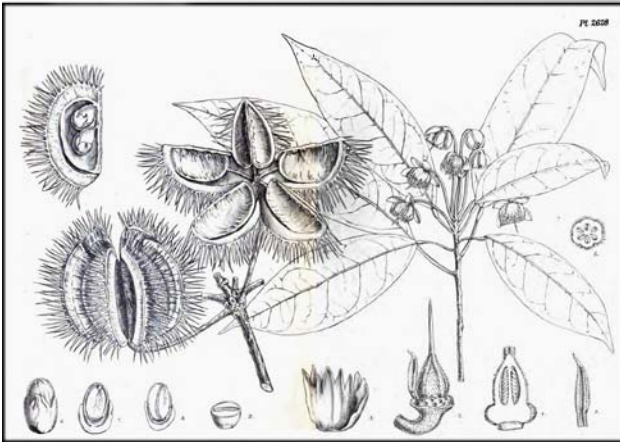
SLOANEA. [Commemorates Sir Hans Sloane, d. 1753, president of the Royal Society, his collections began British Museum.] *Sloanea* is a genus of about 120 species, pantropical, with a few species to the subtropics, about 40 species in Asia, China claims 14 species (seven endemic). There are about six species in Mainland SE Asia; otherwise, the same two species are found from

Malaya to Borneo and north into the Philippines before we encounter about 18 other species in New Guinea.

The genus is distinguished by the anthers that dehisce by two apical pores instead of one pore or by slits, and by the thick woody fruits, sometimes spiny but most always dehiscent with many arillate seeds. In these ways they are very unlike *Elaeocarpus*. The leaves might be confused with *Sterculia*. The species vary across the globe in floral details, the sepals often absent in Neotropical species, while the petals can be fringed or entire or absent altogether. In light of the pantropical distribution and variation in flower and fruit, further molecular studies of *Sloanea* would be interesting. A future division of the genus would not be a surprise. The type species of *Sloanea* is American and many of the Asian species might return to their former names under *Echinocarpus*.

In dry seasonal parts of Asia we find *S. sigun* with densely spiny fruit and small pinnately nerved leaves.

Sloanea



Sloanea. Above left, *S. hongkongensis*, with nodding petulous flowers typical of the family, spiny fruit; upper right and below, *Sloanea javanica*, the dried leaf from Pasoh, Malaya with the nerves merely congested at the base, the blade dries papery and dark brown; below, from the Philippines, the leaves are 3-nerved at the base, the large spineless fruit, here broken open before maturity to show the several seeds and developing arils. (Drawing adapted from *Hooker's Icones Plantarum*, 1901; photographs of fruit © Leonardo L. Co.)

This species, and others in Mainland SE Asia, are sometimes abundant. By contrast, in the lowlands of the Sundaic Region the main species is *S. javanica*, which is usually found consistently and yet always at low densities. The sterile leaf of *S. javanica*, especially the leaves of juveniles, can be confused with Euphorbiaceae and with Malvaceae because the leaf is often three-nerved, long-stalked and bears stipules. However, the leaf stalk of *Sloanea* is not swollen in the typical Malvacean fashion. The lowermost nerves crowd the base, and if clearly three-nerved then they join the midrib slightly above the leaf base. The twigs are resinous rather than mucilaginous, and the blade and young parts are never with stellate hairs. The standard Malay name for the tree is *mendong* or *merchapan* in Iban. The mature dehiscent fruit is illustrated in the *Flora of Peninsular Malaysia* web site and shows a pink-red wall, orange arils and black seeds.

DUBOUZETIA. [Commemorates the French navigator J. du Bouzet, d. 1867.] A genus of 11 species, one of which reaches the Moluccas. The molecular study cited indicates a sister relationship with *Elaeocarpus*. (Not illustrated.)

ACERATIUM. [Greek, “without a small horn” in reference to abruptly terminated anther.] A genus of 20 species found especially in Australia and New Guinea. *Aceratium oppositifolium* approaches the lesser Sunda Islands, and may be found in Sulawesi. It yields a big angular edible fruit, grown in Amboina and referred to as *belimbing-hutan*. Formerly described as an *Elaeocarpus*, it differs in the angular fruit and the opposite leaves. (Not illustrated.)

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FABALES

A small order of only four families, and yet one that is most singularly important because it includes the Fabaceae, one of the most important of plant families. STEVENS *loc. cit.* says of the order “A rather unexpected group, but it is quite strongly supported.” The tree topology is sufficiently unclear that you could find almost

any combination of linkages published in one study or another. Surianaceae 5/8, Australian, scattered globally. 1, *Suriana maritima*, coastal dune shrub, globally. Quilajaceae 1/3, small trees, southern S America. Further comments are reserved for the family treatments.

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ROSIDS (FABIDS): FABALES

POLYGALACEAE

NAME: From the genus *Polygala*, as below.

OVERVIEW: The family Polygalaceae includes about 1000 species arranged in 18 genera with about half the species in *Polygala*. Their distribution is roughly cosmopolitan but absent from New Zealand and poor in Australia. It is a monophyletic family, and perhaps basal to the Fabales^{1,2}. In tropical Asia, the family is chiefly represented by trees of the genus *Xanthophyllum*, a genus that differs vegetatively from other genera by the accumulation of aluminum, by the multiple axillary buds, and by the laminar glands. Other regional representatives include herbs in the genus *Polygala*, as well as a single tree, and a few lianas in *Securidaca*.

Polygalaceae flowers are bisexual, five-parted and pea-like, with the lowermost petal folded to form a boat-shaped keel. The eight stamens are variously united and

fused to the petals (free in *Xanthophyllum*), the gynoecium of two carpels but a single cell with two or more essentially parietal ovules in two rows; the stigma small and two-lobed; the fruit irregularly dehiscent or not.

FIELD RECOGNITION: XANTHOPHYLLUM

Tree of mostly small stature, the bark is green-black, or in older trees pale tan or gray, with thick corky outer bark, warty and lenticellate, breaking apart.

Without exudate; the wood is yellow, oily, granular and crumbles between the fingers.

Simple leaves, blade entire, smooth margin, alternate in a plane, without true stipule, leaf stalk is short, sinuous.

The blade with a yellow mid-rib or with a yellow cast, and especially drying yellow or black, aluminum accumulator.

Multiple axillary buds, twigs often green, discrete shoot system of four or so leaves, abortive terminal bud, axillary buds (often multiple) with odd axillary coverings, scales, together they create a characteristic ‘twiggy’ branch arrangement with prominent scars.

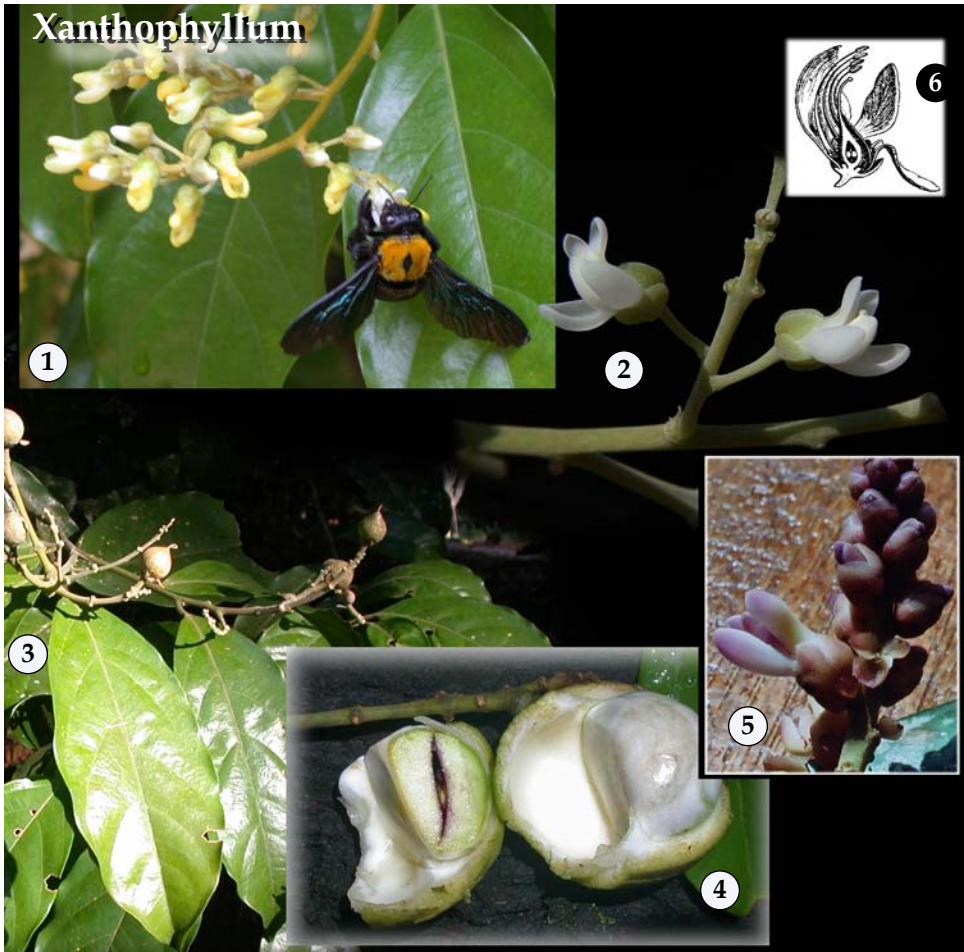
Twigs, bark and wood have a peculiar sour oily odor.

Almost all species have ring-shaped glands in the leaf blade, especially near the apex of the leaf stalk and in the lower part of the blade near the mid rib.

¹Persson, C. 2001. *Taxon*. 50: 763-779.

²Erikson, B. *et al.* 2006. The Families and Genera of Vascular Plants. 9: 345-363.

³van de Meijden, R. 1982. *Leiden Botanical Series*. 7: 1-150.



Xanthophyllum. 1-3, *X. affine*, Pasoh, Malaya, inflorescence, flower and fruit; 4, fruit of *X. lanceatum*, Vietnam, about 3 cm across, 2 or 3 hard seeds covered in fleshy white aril; 5, dense floral stalk and violet petals of *X. adenotus*, Lambir, Sarawak; 5, drawing of flower form. (Drawing 5, from BAILLON *loc. cit.*)

FIELD CONFUSION

The most common error is to misidentify these as *Drypetes* and vice-versa (cf. especially *Drypetes xanthophylloides* of Borneo). The bark can be similar, the yellow wood can be granular in both, the twigs can be green, and the leaves can be without stipules - always in *Xanthophyllum*, sometimes in *Drypetes*. *Drypetes* spp. have one or more of the following features never found in *Xanthophyllum*: stipules, asymmetric leaf base, toothed leaf margin. And in *Xanthophyllum* the twigs are sympodial in construction.

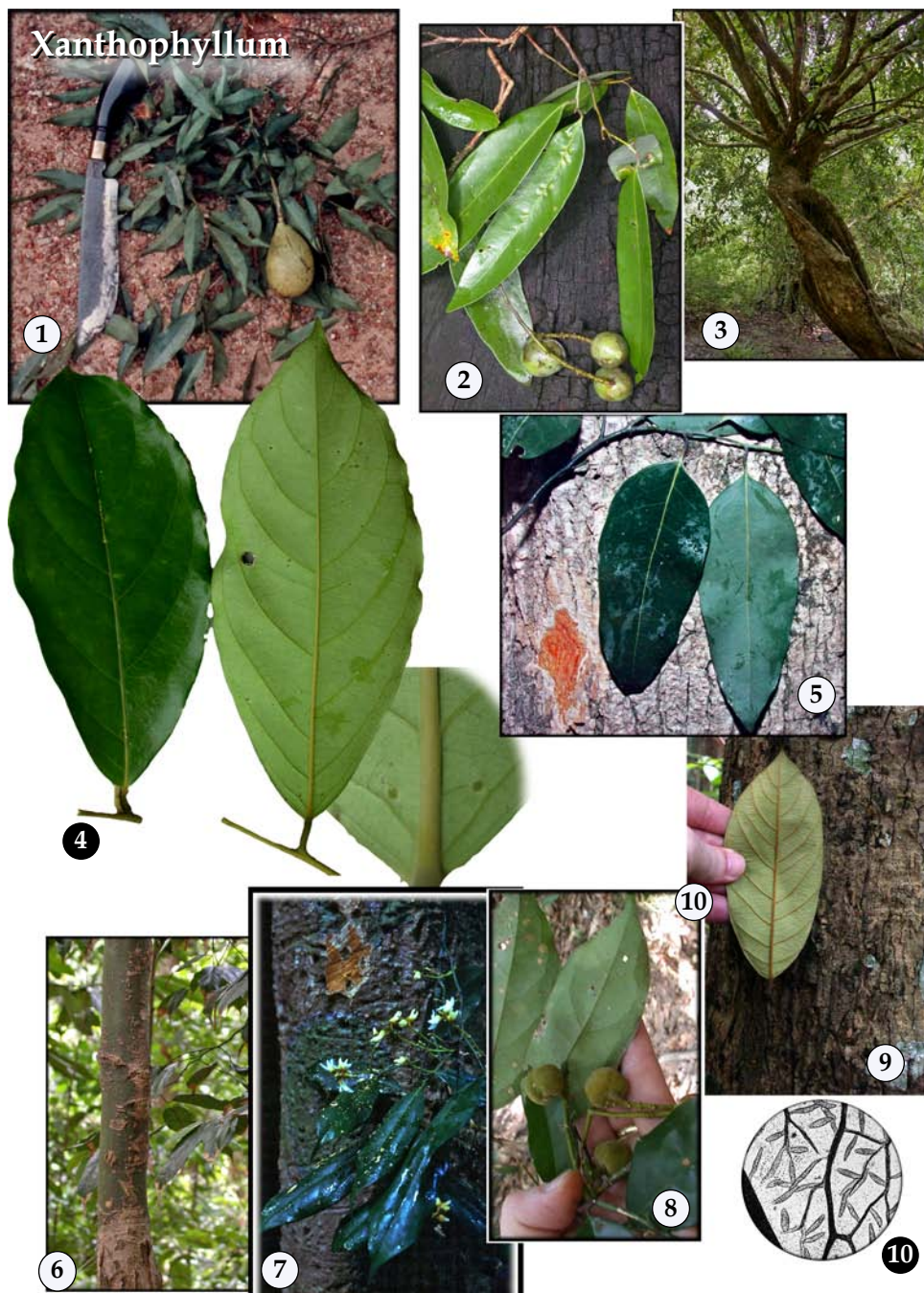
Cleistanthus (Euphorbiaceae), has Phyllanthaceae branching, ordinary lateral twig construction and lacks laminar glands.

Cryptocarya (Lauraceae), with very short leaf stalks and alternate leaves.

The leaf and twig in outline might be mistaken for a *Diospyros* but the ebonies can be distinguished by their whorled branch arrangement, the twigs long with numerous leaves of variant size, the black twigs and white wood, and the leaves when dry are almost never yellow. The glands in the leaves of Ebonies are rarely of the ring sort that is typical in *Xanthophyllum*.

XANTHOPHYLLUM. [Greek, yellow-leaf, the color of the dry leaves.] About 100 species of tropical Asia from India to Australia but strongly centered in richness in the everwet parts of Borneo³, with greatly diminished abundance and diversity in the dry seasonal parts of tropical Asia, and also with altitude, especially above 500 m. About 42 species in Borneo, 30 species in Brunei, 11 on Kinabalu, 27 in Malaya, perhaps only four in the Philippines north of Mindanao, but five others in Mindanao and Palawan; likewise, about 13 endemic to Mainland SE Asia and another five are shared with Malaya. China claims four species, two endemic. Where the trees are abundant they have fairly well established names: *minyak-berok*, monkey-oil in Malaya; the Iban *nyalin* or a variant (*menyalin*, *penyalin*) is common in Borneo. Tagalog speakers are less familiar with the trees but *bok-bok* is reported by MERRILL *loc. cit.*

Most species of *Xanthophyllum* reach maturity between 10 and 20 cm DBH and rarely exceed 20 m



Xanthophyllum. 1, *X. chartaceum* at Pasoh, with large pear-shaped fruit; 2-3, *X. lanceatum* from Vietnam, inundated forest, a short tree, but of large diameter, a malformed twisted trunk, the narrow lanceolate leaves and fruit; 4, *X. affine*, a widespread and heterogeneous species, the population at Pasoh was uniform in leaf form and especially in the presence of paired glands on each side of the midrib; 5, *X. flavescens* in western Thailand, the bark and yellow-orange wood characteristic of the genus; 6-8, the common *X. eurynchum*, flower and fruit at Pasoh, the warty gray bark of older trees, young trees with dark green bark (6, from Singapore), the wood orange-yellow and granular; 9, *X. rufum* from Sarawak with a feltish lower surface, the bark ordinary; 10, a drawing of the odd swollen xylem cells in the cleared leaf. (10, drawn from photomicrographs in Dickinson *loc. cit.*)